

**REMARKS**

Claims 1 through 18 are pending in this Application. Claims 1, 2, 3 and 5 have been amended. Care has been exercised to avoid the introduction of new matter. Indeed, adequate descriptive support for the present Amendment should be apparent throughout the originally filed disclosure as, for example, the depicted embodiments and related discussion thereof in the written description of the specification. Applicants submit that the present Amendment does not introduce any new matter.

**Drawings**

The Examiner objected to the drawings asserting that Figs. 1A - 1D and 2A – 2D should be designated by a legend such as -- PRIOR ART --.

In response, each of Figs. 1A – 1D and 2A - 2D has been amended by providing the legend -  
-PRIOR ART --as suggested by the Examiner, noting the replacement sheets submitted herewith as Exhibit A. Accordingly, withdrawal of the drawing objection is solicited.

**The Specification**

The Examiner objected to the disclosure identifying perceived informalities. In response pages 5 and 9 of the specification have been amended consistent with the Examiner's objections. Accordingly, withdrawal of the objection to the disclosure is solicited.

**Claim Objections**

The Examiner objected to claims 5, 6, 11, 12, 17 and 18, identifying a perceived grammatical error in claim 5. In response claim 5 has been amended addressing the perceived

grammatical error, thereby overcoming the stated basis for the objection. Accordingly, withdrawal of the objection to the claims objections is solicited.

**Claim 1 was rejected under 35 U.S.C. § 102 for lack of novelty as evidenced by Shinichi.**

In the statement of the rejection the Examiner referred to Figs. 1 - 3 of Shinichi, asserting the illustration of a method corresponding to that claimed. This rejection is traversed.

The factual determination of lack of novelty under 35 U.S.C. § 102 requires the identical disclosure in a single reference of each element of a claimed invention, such that the identically claimed invention is placed into the recognized possession of one having ordinary skill in the art. *Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 59 USPQ2d 1489 (Fed. Cir. 2003); *Crown Operations International Ltd. v. Solutia Inc.*, 289 F.3d 1367, 62 USPQ2d 1917 (Fed. Cir. 2002). There are significant differences between the claimed method and Shinichi's method that scotch the factual determination that Shinichi discloses a method identically corresponding to that claimed.

Specifically, the method defined independent claim 1, comprises a sequence of manipulative steps, which include forming a **diffusion barrier film** on a semiconductor substrate, and then forming an insulating film on the diffusion barrier film. Subsequently, a concave is formed in the insulating film by selectively removing the insulating film and the diffusion barrier film. No such manipulative steps are disclosed or suggested by Shinichi. Specifically, it is not apparent wherein Shinichi discloses a method corresponding to that defined in independent claim 1 which comprises, *inter alia*, forming a **diffusion barrier metal film** on a semiconductor substrate and then forming a insulating film on the diffusion barrier film, as in the claimed invention.

The above argued differences and manipulative steps between the claimed method and Shinichi method undermine the factual determination that Shinichi discloses a method identically corresponding to that claimed. *Minnesota Mining & Manufacturing Co. v. Johnson & Johnson Orthopaedics Inc.*, 976 F.2d 1559, 24 USPQ2d 1321 (Fed. Cir. 1992); *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986). Applicants, therefore, submit that the imposed rejection of claim 1 under 35 U.S.C. § 102 for lack of novelty as evidenced by Shinichi is not factually viable and, hence, solicit withdrawal thereof.

**Claims 1 and 3 were rejected under 35 U.S.C. § 102 for lack of novelty as evidenced by Lukanc et al.**

In the statement of the rejection the Examiner referred to Figs. 4 through 6 of Lukanc et al., asserting the illustration of a method corresponding to that claimed. In support of that determination the Examiner asserted the disclosed method would inherently involve two separate polishing slurries. This rejection is traversed.

Again, the factual determination of lack of novelty under 35 U.S.C. § 102 requires the identical disclosure in a single reference of each element of a claimed invention, such that the identically claimed invention is placed into the recognized possession of one having ordinary skill in the art. *Dayco Products, Inc. v. Total Containment, Inc.*, *supra*; *Crown Operations International Ltd. v. Solutia Inc.*, *supra*. There are significant differences between the methods defined in independent claims 1 and 3 on the one hand, and the method disclosed by Lukanc et al. on the other hand, that scotch the factual determination that Lukanc et al. disclose a method identically corresponding to those claimed.

Specifically, each of independent claims 1 and 3 is directed to a method comprising a sequence of manipulative steps. That sequence of manipulative steps includes forming a diffusion barrier film on a semiconductor substrate, and then forming an insulating film on the diffusion barrier film. Subsequently, a concave is etched in the insulating film by selectively removing the insulating film and the diffusion barrier film. No such manipulative steps are disclosed or suggested by Lukanc et al. Indeed, it is not apparent wherein Lukanc et al. disclose a method comprising forming a diffusion barrier film on a semiconductor substrate and subsequently forming an insulating film in which a concave is selectively etched on the diffusion barrier film, as in the claimed methods.

The above argued differences in manipulative steps between the claimed methods and the methodology of Lukanc et al. undermine the factual determination that Lukanc et al. disclose a method identically corresponding to those claimed. *Minnesota Mining & Manufacturing Co. v. Johnson & Johnson Orthopaedics Inc., supra*, *Kloster Speedsteel AB v. Crucible Inc., supra*. Applicants, therefore, submit that the imposed rejection of claims 1 and 3 under 35 U.S.C. § 102 for lack of novelty as evidenced by Lukanc et al. is not factually viable and, hence, solicit withdrawal thereof.

**Claims 1 through 8 were rejected under 35 U.S.C. § 103 for obviousness predicated upon Sameshima et al. in view of Lukanc et al.**

In the statement of the rejection the Examiner asserted that one having ordinary skill in the art would have been motivated to modify the methodology of Sameshima et al. by incorporating teachings of Lukanc et al. with respect to the formation of a sacrificial layer and etching technique. This rejection is traversed.

Each of independent claims 1, 2, 3 and 5 is directed to a method comprising a sequence of manipulative steps, which sequence of manipulative steps include forming a diffusion barrier film and then forming an insulating film on the diffusion barrier film with subsequent etching to form an opening by selectively removing the insulating film and the diffusion barrier film. It is not apparent wherein either of the applied references discloses or suggests such manipulative steps, notably the use of a diffusion barrier film as in the claimed invention. Accordingly, even if the applied references are combined as suggested by the Examiner, and Applicants do **not** agree that the requisite fact-based motivation has been established, the claimed invention would **not** result. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988). Ergo, a *prima facie* basis to deny patentability to the claimed invention under 35 U.S.C. § 103 has not been established for lack of the requisite factual basis. Moreover, there is a potent indium of **nonobviousness** which requires reconsideration.

#### **Indium of Nonobviousness**

It is well settled that the **problem** addressed and solved by a claimed invention must be given consideration in resolving the ultimate legal conclusion of obviousness under 35 U.S.C. § 103. *North American Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 28 USPQ2d 1333 (Fed. Cir. 1993); *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 15 USPQ2d 1321 (Fed. Cir. 1990); *In re Newell*, 891 F.2d 899, 13 USPQ2d 1248 (Fed. Cir. 1989); *In re Nomiya*, 509 F.2d 566, 184 USPQ 607 (CCPA 1975). The present invention addresses and solves a particular problem which arises in conventional damascene processing. The particular problem addressed and solved by the claimed invention is that the upper part of an interconnect trench 117 is etched in the form of a taper **when a diffusion barrier film 105 is removed by etching**. The undesirable formation of such a

taper results in a parasitic capacitance and short circuiting failures, particularly as microminiaturization proceeds apace.

Applicants address and solve that problem by strategically controlling the second polishing step during chemical-mechanical polishing (CMP) to remove at least a part of the conventionally formed normal taper in the upper part of a concave formed in the insulating film or of the interconnect trench (independent claims 1 and 2). In this way short circuiting is prevented. Moreover, by providing a sacrificial film on the insulating film according to another embodiment of the present invention, etching of the corner in the upper part of the concave formed in the insulating film or in the interconnect trench is prevented, and removal of a taper in the upper part of a concave or the interconnect trench is facilitated (independent claims 3 and 5). None of the applied references appreciates the problem addressed and solved by the claimed invention which is illustrated in Fig. 2A of the present application, i.e., the formation of a taper, or normal taper, during conventional methodology employed when etching the upper part of the interconnect trench 117 during etching of the diffusion barrier 105. Absent any such appreciation of the problem, it cannot be said that one having ordinary skill in the art would have been realistically motivated to modify any steps of the applied references to eliminate that problem. In this respect see *Ecolochem Inc. v. Southern California Edison, Co.*, 227 F.3d 1361, 56 USPQ2d 1065 (Fed. Cir. 2000). Moreover, the failure of the applied references to express any appreciation of this problem addressed and solved by the claimed invention constitutes a potent indication of **nonobviousness**. *North American Vaccine, Inc. v. American Cyanamid Co.*, *supra*; *Northern Telecom, Inc. v. Datapoint Corp.*, *supra*; *In re Newell*, *supra*; *In re Nomiya*, *supra*.

### Conclusion

Based upon the foregoing it should be apparent that a *prima facie* basis to deny patentability to the claimed invention has not been established for lack of the requisite factual basis and want of the requisite realistic motivation. Moreover, upon giving due considerations to the problem addressed and solved by the claimed invention, the conclusion appears inescapable that one having ordinary skill in the art **would not** have found a claimed invention **as a whole** obvious within the meaning of 35 U.S.C. § 103. *Jones v. Hardy*, 727 F.2d 1524, 220 USPQ 1021 (Fed. Cir. 1984).

Applicants, therefore, submit that the imposed rejection of claims 1 through 18 under 35 U.S.C. § 103 for obviousness predicated upon Sameshima et al. in view of Lukanc et al. is not factually or legally viable and, hence, solicit withdrawal thereof.


Based upon the foregoing it should be apparent that the objections and rejections have been overcome, and that all pending claims are in condition of immediate allowance. Favorable consideration is, therefore, respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

**Application No.: 10/724,111**

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

  
Arthur J. Steiner  
Registration No. 26,106

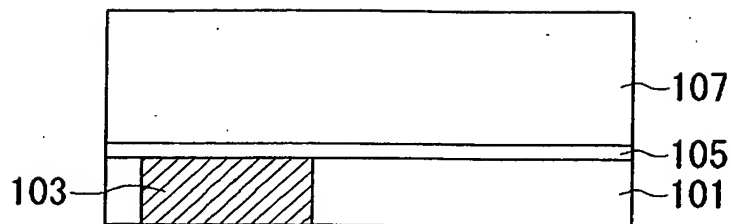
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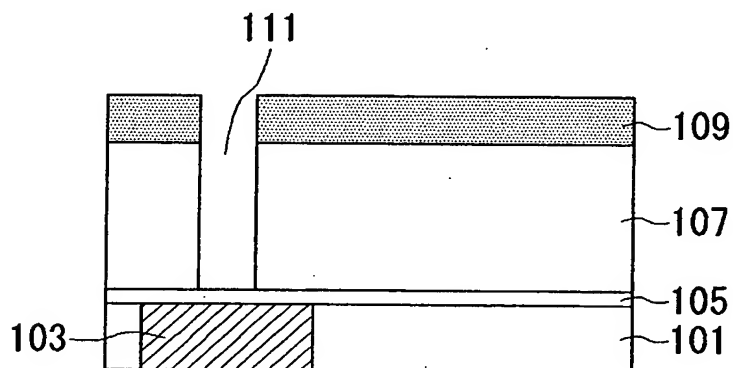
**AMENDMENTS TO THE DRAWINGS**

The attached REPLACEMENT SHEETS (Exhibit A) of drawings include changes to each of Figs. 1A - 1D and 2A - 2D, replacing the original drawing sheets for these Figures. In each of Figs. 1A -1D and 2A -2D, the legend "PRIOR ART" has been added.

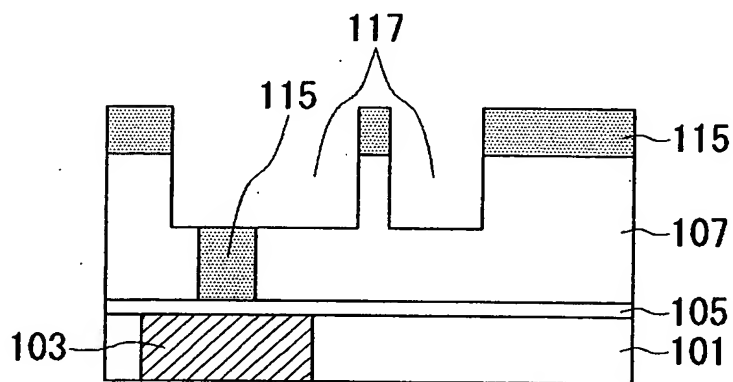
**FIG.1A**  
PRIOR ART



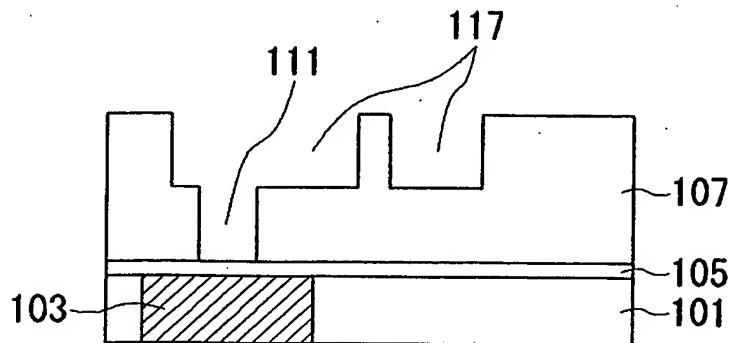
**FIG.1B**  
PRIOR ART



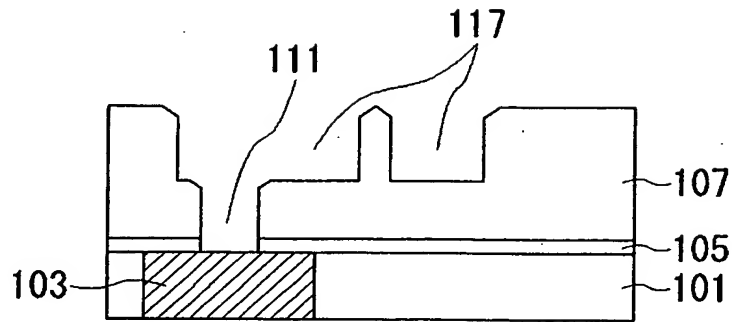
**FIG.1C**  
PRIOR ART



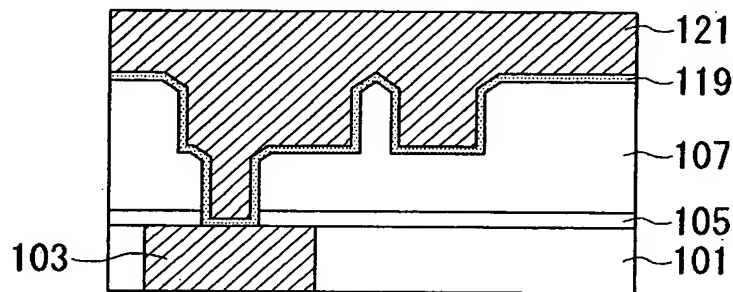
**FIG.1D**  
PRIOR ART



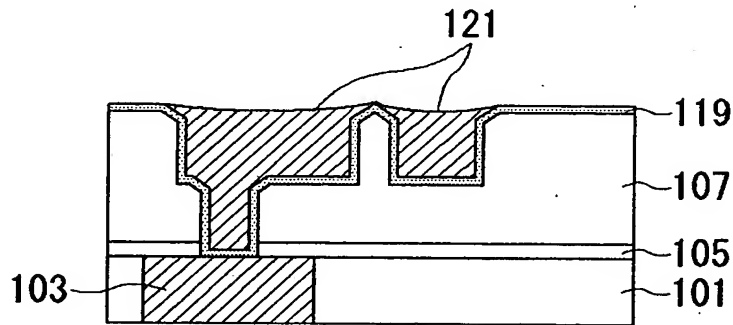
**FIG.2A**  
PRIOR ART



**FIG.2B**  
PRIOR ART



**FIG.2C**  
PRIOR ART



**FIG.2D**  
PRIOR ART

